Two tier labor market reform: A quantitative general equilibrium assessment

Claudio Campanale*
Universidad de Alicante
CeRP (Collegio Carlo Alberto)

Francesco Turino†
Universidad de Alicante

September 3, 2015

*Corresponding author: Claudio Campanale, Departamento de Fundamentos del Análisis Económico, Universidad de Alicante, Ctra. San Vicente del Raspeig s/n, 03690, Alicante, Spain. Phone: +34 965903614. Fax: +34 965903898. Contact email: claudio@ua.es

†Departamento de Fundamentos del Análisis Económico, Universidad de Alicante, Ctra. San Vicente del Raspeig s/n, 03690, Alicante, Spain. Phone: +34 965903614. Fax: +34 965903898. Contact email: fturino@ua.es

We wish to thank Carolina Silva for helpful comments. We are grateful to the Spanish Ministry of Science and Innovation (ECO2012-36719) and the Generalitat Valenciana (PROMETEO/2013/037) for financial support. Claudio Campanale wishes also to thank Collegio Carlo Alberto for financial support and CeRP and IIES for hospitality during the development of this project. All errors and inconsistency are our own.

Abstract

In the 1990s several European countries liberalized the use of fixed-term labor contracts in an effort to reduce persistently low employment growth. This article studies the effect of these reforms through the lens of a version of the Hopenhayn and Rogerson (1993) model calibrated on Italian data. We find no effect of the reform on total employment in steady-state.

Keywords: Labor Market Reforms, Employment, General Equilibrium, Italy
JEL codes: E24

1 Introduction

During the 1980s to the mid-1990s several European countries experienced a long period of "jobless growth". Concerned with the persistently high unemployment levels, governments introduced reforms to the Employment Protection Legislation (EPL) that took the shape of a liberalization in the use of temporary (fixed term) labor contracts. At the same time permanent (open-end) contracts were largely left unchanged giving rise to a two-tier labor market. Since then, these countries have experienced notable increases in employment despite relatively slow growth.[1] At the same time some of those countries, among them Italy, experienced a slowdown in average productivity growth as documented for example in Orsi and Turino (2014).

In the current paper we explore the effects of the introduction of temporary contracts through the lens of a general equilibrium quantitative model. More specifically, we extend the model of Hopenhayn and Rogerson (1993) to allow for heterogeneity of workers' ability. Instead of studying the effect of a reduction in the level of firing costs — like in Hopenhayn and Rogerson (1993) — we model the relaxation in the EPL by introducing the possibility of hiring workers through contracts that are not subjected to firing costs, in line with the features of the European reforms. We compare the stationary equilibria of two economies: in the first economy there are only permanent contracts with an associated high firing cost. In the second economy firms can hire workers both under permanent contracts and through temporary contracts with no associated firing cost. To the extent possible we calibrate the economies using Italian data. The main finding of this exercise is that the introduction of temporary contracts leaves the level of employment in steady-state virtually unchanged. The model also generates a reduction in average labor productivity. While the first result is in contrast with the recent experience, the second one is in line with the slowdown in productivity that we see in some of the reforming countries, among them Italy (see e.g. Dew-Becker and Gordon, 2012). The negative result in terms of employment growth, though confirms previous literature, including Boeri and Garibaldi (2007), Alonso-Borrego *et al.*

[1] See Boeri and Garibaldi (2007).

(2005) and Blanchard and Landier (2002).

2 Model

The economy consists of a continuum of identical households and a continuum of firms. There is “microeconomic”uncertainty in the form of firm specific productivity shocks, but not aggregate uncertainty.

2.1 Firms

2.1.1 Technology

In each period t, a firm i that is active in the market produces an amount of output $y_{i,t}$ by renting capital $k_{i,t}$, and hiring labor $n_{i,t}$ in the form of both temporary and permanent workers. Firms are price takers and therefore take as given the rental rate of capital, r_t, and the wage rate, w_t, which is defined per unit of efficiency that we denote with z. We assume that labor hired in permanent contracts is more efficient by a factor $\lambda > 1$ than labor hired in temporary contracts. That is, if the firm hires $z^p_{i,t}$ units as permanent and $z^n_{i,t}$ as temporary workers, the total amount of labor hired is $n_{i,t} = \lambda z^p_{i,t} + z^n_{i,t}$. To produce output, a firm uses a stochastic production function with decreasing returns to scale $f\left(k_{i,t}, n_{i,t}, A_{i,t}\right)$ where $A_{i,t}$ denotes a firm-specific technological shock, which is independent across firms and follows a first-order Markov process with conditional distribution $F(A_{i,t+1}|A_{i,t})$. [2]

Under the above structure, the per period profit function of an active firm i at date t can be written as

$$\pi_{i,t} = p_t f\left(k_{i,t}, n_{i,t}, A_{i,t}\right) - (r_t + \delta)k_{i,t} - w_t(z^p_{i,t} + z^n_{i,t}) - p_t c_f - \tau max\left\{0, z^p_{t-1} - z^p_t\right\}$$

where p_t stands for the market price of output; $\tau > 0$ is the firing cost for one efficiency unit of labor employed as permanent; $\delta \in (0, 1)$ is the depreciation rate of capital; and $c_f >$

[2] The production function and the distribution used in the analysis will satisfy the usual assumptions needed to guarantee uniqueness of the equilibrium. See Hopenhayn and Rogerson (1993)

0 is a fixed operating cost (defined in units of output) incurred by the firm in each period in which it remains in the market.

2.1.2 Incumbent firms

At the beginning of a given period, before receiving any information about its current level of productivity A, an incumbent firm that employed z^p permanent workers in the previous period has to decide whether to exit or to remain in the market.[3] If the firm exits, it implicitly sets its current level of permanent workers $z^{p\prime}$ equal to 0 and must pay the firing cost τz^p, but avoids the payment of the fixed operating cost. If the firm stays, it chooses capital, permanent and temporary workers by solving the following stationary dynamic program:

$$V(A, z^p; \varpi) = \max_{k, z^n, z^{p\prime}} \pi + \beta \max \left\{ EV(A', z^{p\prime}; \varpi); -\tau z^{p\prime} \right\} \tag{1}$$

where $\beta \in (0, 1)$ denotes the discount factor, and $\varpi = (w, p, r)$ is the vector of market prices that firms take as given.[4] The solution of the above problem consists of four decision rules for each firm: $K(A, z^p; \varpi)$, $Z^n(A, z^p; \varpi)$ and $Z^p(A, z^p; \varpi)$ for capital, temporary workers and permanent workers, respectively; and $X(A, z^p; \varpi)$ which captures the optimal exit/stay decision.

2.1.3 Entry

In each period t, there is an unbounded mass of prospective entrants. If a firm decides to enter, it has to pay the sunk entry cost $p_t c_e > 0$, which is denominated in units of output. The value of entering gross of the entry sunk cost is defined as

$$V^e(\varpi) = \int V(A, 0; \varpi) dv(A) \tag{2}$$

where $V(\cdot)$ is the value function that solves the Bellman equation (1), while v is the distribution of productivity levels of entrants. These technology shocks are assumed to be

[3] Given stationarity of the problem we have removed time indexes.

[4] Notice that the maximization operator that appears in the right-hand side of the program captures the incumbent firm's exit decision at the beginning of the next period.

independently and identically distributed across entering firms and $v(\cdot)$ is constant over time and independent of the number of entrants. Once the sunk entry cost has been paid, an entrant chooses the demand of capital, permanent workers, temporary workers and the exit/stay strategy by solving problem (1) with $z^p = 0$ and where the productivity level is drawn from the distribution v.

2.2 Households

There are identical households uniformly distributed on the interval $[0, 1]$. As in Chang (2000), we assume that each household consists of a continuum of heterogenous members indexed by the ability $z \in [\underline{z}, \overline{z}] \subset R_+$, and with a time endowment that is assumed to be equal to 1 in each period. Each of those household's members may either work at home or inelastically supply his whole time endowment in the market. If he works in the market, he receives a wage $w_t z$. If he works at home, he produces $h_t(z)$ units of home-produced good via the following technology:

$$h_t(z) = \alpha(z)(1 - l_t(z)) \tag{3}$$

where $\alpha(z)$ is a strictly increasing and a strictly concave function of z, while $l_t(z)$ is an indicator function that takes value 1 if the agent works in the market and 0 otherwise. Concavity of the function $\alpha(z)$ and linearity in the earnings function jointly imply that there exists an ability threshold, $z_t^* \in [\underline{z}, \overline{z}]$, such that a family member with index z works at home only if $z < z_t^*$.

The household derives utility, $u(C_t, H_t)$, from the consumption of market-produced goods C_t and home-production H_t.Denoting by $\epsilon(z)$ the distribution of abilities across household members, it follows that total home production and total earnings E_t of a household are respectively given by the following equations

$$H_t = \int_{\underline{z}}^{z_t^*} h_t(z)\epsilon(z)dz; \quad E_t = w_t L^s(z_t^*) = \int_{z_t^*}^{\overline{z}} w_t z \epsilon(z)dz \tag{4}$$

where $L^s(z_t^*)$ stands for the household's labor supply. We assume that the household rents whatever capital it owns to firms. The household's capital stock evolves according to the law of motion $K_{t+1} = (1-\delta)K_t + I_t$, where I_t denotes investment. Furthermore, households receive pure profits, Π_t, for the ownership of firms, which implies that in each period of time, the representative household faces the budget constraint $p_t(C_t + I_t) = r_t K_t + E_t + \Pi_t + R_t$, where R_t is the transfer received as compensation for the firing of household's members that were employed in the previous period as permanent workers.[5] The representative household's problem is then to choose the process $\{C_t,\ K_{t+1},\ z_t^*\}_{t=0}^{\infty}$ so as to maximize the inter-temporal utility function

$$\sum_{t=0}^{\infty} \beta^t u(C_t, H_t)$$

subject to the law of motion of capital, the budget constraint and the home production technology.

2.3 Equilibrium

We consider stationary equilibria where all the aggregate variables, prices, mass of entrants and distribution of incumbents stay constant over time. Additionally, we focus on equilibria where the good price p is normalized to 1 in each period. Constancy of prices and allocations implies that the equilibrium rental rate r is independent of the number of entrants and the distribution of incumbents. Thus, the real wage rate w is the only price that remains to be determined in equilibrium. For this reason, in what follows we will refer to w instead of the vector of prices ϖ.

Some notation is necessary before introducing a formal definition of equilibrium. To this end, let $\mu(A, z^p)$ denote the distribution of incumbents with respect to the state variables (A, z^p), and let M denote the mass of firms that enter the market. The measure μ generally changes period-by-period as a result of entry, the incumbents' optimal decisions and the exogenous process for A. In what follows, we summarize the transition from the distribu-

[5]For simplicity we assume that all the firing cost is rebated back to the household. Garibaldi and Violante (2005) show that in Italy the severance payment is only part of the firing cost. This simplification is legitimate in our model since what matters is the total firing cost paid by the firm. Also households are the ultimate receiver of any income including lawyer fees and other legal expenditures.

tion μ to the new distribution μ' in the next period as $\mu' = T(\mu, M; w)$. One interesting property of the model is that its stationary equilibrium can be fully characterized by the triple (μ, M, w). The next definition uses this property to formally describe a stationary equilibrium for the economy.

Definition 1. *We define a stationary equilibrium for the economy as a wage rate w^*, a mass of entrants M^* and a distribution of incumbents μ^* such that*

(i) $L^d(\mu^*, M^*; w^*) = L^s(z^*(\mu^*, M^*; w^*))$

(ii) $\mu^* = T(\mu^*, M^*; w^*)$*;*

(iii) $V^e(w^*) = c_e$

Condition (i) states that the labor market must clear in equilibrium.[6] Condition (ii) requires that the distribution of firms stays constant in the stationary equilibrium. Finally, condition (iii) is a free entry condition, stating that the inflow of firms occurs up to the point in which the gross expected gain from entry is equal to the sunk entry cost.[7]

3 Model specification and calibration

For the production function we specify a standard Cobb-Douglas form: $y_{i,t} = A_{i,t}k_{i,t}^{\alpha}n_{i,t}^{\gamma}$ where $y_{i,t}$ is the output of firm i at time t. For the period utility function $u(C_t, H_t)$ we assume a logarithmic form defined on a CES aggregate of market and home goods. Letting this aggregate be denoted with $\tilde{C}$ this will read:

$$\tilde{C}_t = [C_t^e + BH_t^e]^{\frac{1}{e}}$$

where B is a parameter that measures the relative weight of home goods in the utility index and $\frac{1}{1-e}$ is the elasticity of substitution between home and market goods. Following

[6]The labor supply is defined in equation 4, the labor demand is obtained by integrating the decision rules for permanent and temporary labor over the stationary distribution.

[7]Hopenhayn and Rogerson (1993) use a similar definition of equilibrium.

Table 1: **Parameters**

Parameter	Value	
β	0.96	
α	0.28	Alonso-Borrego et al. (2005)
γ	0.62	Alonso-Borrego et al. (2005)
δ	0.10	Chang (2000)
$\rho_A - \sigma_A$	0.825 – 0.219	
τ	4.8	
c_f	1.08	
λ	1.835	
α_0	1.0	Chang (2000)
α_1	0.75	Chang (2000)
e	2/3	Greenwood et al. (1993)
B	1.19	

Chang (2000) the function that defines the productivity of a member of the household when working at home is $\alpha(z) = \alpha_0 z^{\alpha_1}$.

Parameters are then chosen according to standard calibration practices. Some are taken from values commonly used in the literature. In these cases, to economize on space we simply report the source in table 1. The remaining parameters are chosen so that certain moments of the model steady-state match their empirical counterparts. In these cases, as long as possible we use data from Italy, one of the countries that liberalized the use of fixed-term contracts. We describe them briefly in what follows. Table 1 summarizes all the parameters' values.

The value of B is set so that the model with only permanent contracts generates a level of employment of about 52.5 percent of the working age population, consistent with data from Italy in 1995, before the reform. [8] The stochastic process for the firm's technology is specified as an AR(1) process. The two parameters that define this process — that is, the autocorrelation coefficient ρ_A and the standard deviation of the innovation σ_A — together with the fixed cost of operating a firm c_f are jointly set so that the model roughly matches the age distribution of Italian firms taken from Eurostat.[9] The firing cost τ is set so that the model with one contract generates a firing rate in continuing firms in line with the one reported by Corsino *et al.* (2010) for Italian firms just before the labor market reform. The distribution of skills in the population is assumed to be log-normal and is estimated by using the procedure outlined in Chang (2000) and applying it to Italian wage data taken from the Italian 1995 "Survey of Household Income and Wealth" compiled by the Bank of Italy.

We perform the following experiment. First we solve for the steady-state of the model where only permanent contracts are allowed. Then we solve an equally parameterized model where both permanent contracts and temporary contracts are allowed. This leads to the calibration of the remaining parameter λ which represents the relative productivity of one efficiency unit of labor in permanent versus temporary jobs. The parameter is set in both models so that in the model with both types of contracts the share of temporary contracts matches the value published by the Italian statistical office (ISTAT) in its quarterly survey of the labor market and refers to the decade 2000-2010, that is, after the implementation of the reform. The value of λ that achieves this is 1.835. The value of λ is kept constant at this level across the model with and without fixed-term contracts. The change in employment and average labor productivity between the two steady-states represents our assessment of the effects of the reform.

[8] The source of this data is the volume "Rapporto Annuale", 2012, published by ISTAT, the Italian statistical office.

[9] Eurostat data allow us to compute the age distribution of firms for the years 2003-2007. We use an average of those five years here.

Table 2: **Basic statistics**

Variable	Model	Data
Firing rate	2.97	3.15
Share employed	52.8	52.5
Share 1 year	5.72	5.12
Share 2 years	2.21	5.02
Share 10+ years	78.7	86.7

4 Results

We present the results in tables 2 and 3. In table 2 we report some basic statistics in the model with only permanent contracts and in the data. As we can see from the first line the firing rate in surviving firms is 2.97 percent in the model and 3.15 percent in the data. The percent of employed population is 52.8 percent in the model and 52.5 percent in the data. Next in lines 3, 4 and 5 we report three points of the age distribution of firms. In the data the share of firms with one year of life is 5.1 percent, the share of two year-old firms is 5.02 percent and the fraction of firms ten or more years old is 86.7 percent. In the model the corresponding figures are 5.72 percent, 2.21 percent and 78.7 percent. The model thus produces values that are close to their empirical counterparts, except perhaps for the share of two year-old firms that is somewhat further from the data; suggesting that we achieved a reasonable calibration.

Next we solve the model with both fixed term and permanent contracts. The first line of table 3 reports the results concerning the impact of the introduction of fixed term contracts on employment in the baseline case. As we can see the share of the population employed moves from 52.8 percent to 52.6 percent corresponding to a reduction of 0.4 percent. In the last column we can see that the share of temporary contracts over the total amount of workers is 14 percent, a value close to the 14.4 percent that we find in the Italian data for

Table 3: **Results analysis**

	Employment		%Δ(employment)	share temporary
	One contract	Two contracts		
$\lambda = 1.835$	52.8	52.6	-0.4	14.0
$\lambda = 1.68$	49.8	50.79	+1.99	40.4
$\lambda = 1.54$	47.01	49.73	+5.76	74.8
$\lambda = 1.46$	45.35	49.3	+ 8.7	93.2

the decade 2000-2010.[10] Finally, not reported in the table, the model generates a decrease in labor productivity of 8.5 percent. The first result confirms previous findings in Alonso-Borrego *et al.* (2005), Blanchard and Landier (2002) and Boeri and Garibaldi (2007), that the introduction of temporary contracts had at best a neutral effect and possibly a negative effect on employment. The result concerning productivity stands in contrast to Alonso-Borrego *et al.* (2005). It must be said though that in Italy the introduction of temporary contracts was followed by a slowdown in labor productivity growth. Our model does not feature long term growth. However the fact that moving from the stationary equilibrium of the model with only permanent contracts to the one with both types of contracts reduces average labor productivity suggests that this labor reform may have played a role in the observed Italian productivity slowdown.

The remaining lines of table 3 suggest an interpretation of our finding. We re-run the two versions of the model with different values of λ, the parameter that controls the relative productivity of the efficiency units of labor when employed in permanent and temporary contracts. As we can see as the value of λ goes down the variation in employment becomes larger. With λ equal to 1.68 introducing temporary contracts raises employment by about 2 percent, when λ is equal to 1.54 employment increases by 5.76 percent and when λ is

[10]This being a further target that we match closely it lends further support to our calibration.

1.46 employment increases by 8.7 percent. On the other hand though by looking at the last column we see that the share of temporary over total jobs increases towards very high values: it is 40.4 percent when λ is equal to 1.68 and 74.8 percent when λ is equal to 1.54.

In the presence of dismissal costs labor units need to be more productive when employed in permanent jobs. The higher their relative productivity the higher the incentive for firms to use permanent contracts. On the other hand, as in the Hopenhayn-Rogerson model, the higher flexibility of lower firing costs — actually zero for temporary jobs in our model — promotes higher employment. As λ decreases the relative convenience of hiring in temporary jobs increases, their share increases, hence the impact on total employment becomes stronger. On the other hand the calibration provides discipline as to the value that λ can take and as it turns out, when we match the share of temporary workers to the empirical counterpart, introducing temporary workers leads to virtually no effect of the reform on employment.

5 Conclusions

In this paper we analyze the effects of two tier labor market reforms through the lens of a general equilibrium model of industry dynamics in the spirit of Hopenhayn and Rogerson (1993). Whenever possible the model has been calibrated on the Italian economy, one of the countries where the 90's labor market reform took place. We find that the effects of this type of labor market reform are mostly concentrated on labor productivity, which in our model, as in the Italian data, declines in the aftermath of the reform. By contrast, our model predicts that, *per se*, the liberalization of fixed term labor contracts left the employment level virtually unaffected. This result conforms to previous findings in the literature (i.e. Blanchard and Landier, 2002; Alonso-Borrego *et al.*, 2005; Boeri and Garibaldi, 2007). We leave to future research the study of what may have caused the increase in employment in the economies that introduced reforms to EPL similar to the ones considered in the present work.

References

Alonso-Borrego, C., Fernández-Villaverde, J., and Galdón-Sánchez, J. E. (2005). "Evaluating Labor Market Reforms: A General Equilibrium Approach". NBER Working Papers 11519, National Bureau of Economic Research, Inc.

Blanchard, O. and Landier, A. (2002). "The Perverse Effects of Partial Labour Market Reform: fixed–Term Contracts in France". *Economic Journal*, **112**(480):F214–F244.

Boeri, T. and Garibaldi, P. (2007). "Two Tier Reforms of Employment Protection: a Honeymoon Effect?" *Economic Journal*, **117**(521):357–385.

Chang, Y. (2000). "Wages, Business Cycles, and Comparative Advantage". *Journal of Monetary Economics*, **46**(1):143–171.

Corsino, M., Gabriele, R., and Trento, S. (2010). "Job flows in Italian SMEs: a longitudinal analysis of growth, size and age". DISA Working Papers 1008, Department of Computer and Management Sciences, University of Trento, Italy.

Dew-Becker, I. and Gordon, R. J. (2012). "The Role of Labor-Market Changes in the Slowdown of European Productivity". *Review of Economics and Institutions*, **3**(2).

Garibaldi, P. and Violante, G. L. (2005). "The employment effects of severance payments with wage rigidities". *Economic Journal*, **115**(506):799–832.

Hopenhayn, H. and Rogerson, R. (1993). "Job Turnover and Policy Evaluation: A General Equilibrium Analysis". *Journal of Political Economy*, **101**(5):915–38.

Orsi, R. and Turino, F. (2014). "The last fifteen years of stagnation in italy: a business cycle accounting perspective". *Empirical Economics*, **47**(2):469–494.